

Tribute to Francisco (Paco) Yndurain

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This part of the talk aims to present briefly the biodata and the exceptional career of Paco Yndurain who left us suddenly in June 2008. The scientific part: *Light Scalar Mesons in QCD* is published in the proceedings of QCD 08 (Montpellier 7-12th july 2008: arXiv:0811.0563 [hep-ph]).

8th Conference Quark Confinement and the Hadron Spectrum
September 1-6 2008
Mainz, Germany

*Speaker.

[†]Invited plenary talk.

1. Introduction

These last months were very sad for our community as we have suddenly lost our colleagues and friends:



Paco YNDURAIN (Dec. 1940 - June 2008), Jan STERN (June 1942 - July 2008) and Giuseppe NARDULLI (July 1948 - June 2008) ¹.

Before starting my talk dedicated to Paco Yndurain, I ask 1mn of silence for their memory.

2. Introduction to Paco



Paco at QCD 06

¹The two first photos have been taken during Paco and Jan participation at QCD 06 (Montpellier, 4-7th July 2006).

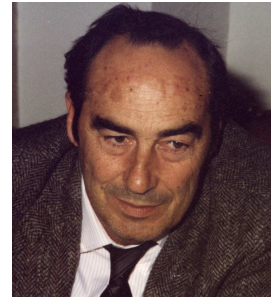
I met Paco in 1975 when preparing my “Doctorat of 3ème cycle” in Marseille on the “hadronic contributions to the muon anomalous magnetic moment”, where he has been one of the referees of my thesis. In that time, I have been impressed by his physics intuition and knowledge and by his friendship. I have appreciated his human relation and also benefited from his encouragement during his multiple visits to Marseille. Later on in 1979, we have started to work on the “sum of light the quark masses in QCD” with Carlo Becchi and Eduardo de Rafael. He has invited me to the Pyrenees school and then to Madrid in 79. Driving to Madrid, he has friendly convinced me to compute the radiative corrections to the (pseudo)scalar two-point correlator which few months later becomes the first calculation of this quantity and the first prediction on the running values of the sum of light quark masses in QCD. Since then, though we have not worked directly together, we have continued to share our interests in physics (especially in QCD). Paco was also the International Committee member of the QCD Conference series in Montpellier since its creation in 1985, where he came often as an active participant.

In the following, I shall give a short review of his formation and brilliant career ².

3. Paco formation and itinerary

University of Zaragoza

- Master in Mathematics 1962,
- PhD in Physics 1964: “Definitions of hamiltonians and renormalization”
- Assistant Prof. 64-66



University of New York

- Fullbright Fellow 66-67
- Associate Researcher 67-68

CERN Theory Division

- Research Fellow 68-70
- Senior Scientific Associate 76 and 85

University of Madrid

- Professor 1970 U. Complutense
- Full Professor since 1971 in the Autònoma University.

Paco is reputed to be an Excellent Teacher !

²Some parts of this talk have been inspired from the one of José Pelaez at QCD 08 (7-12th July 2008, Montpellier).

4. PACO (important) positions

- Director of the Theoretical Physics Department UAM, 74-77, 81-84
- Dean of the UAM Science Faculty 1975
- Research Vice-rector UAM 78-81
- Scientific Advisor of IBM 83-85 and of Scientific Research of Kuwait 80-82
- Elected Member of the Eur. Phys. Soc., 83-89
- Elected Member of the Scientific Policy Committee of CERN, 88-94.
- Elected Member by the Senate of the Spanish University Council
- Elected Member of the World Innovation Foundation, London, 2001
- Elected President of the Physics and Chemistry Section of the Spanish Royal Academy 2002.



Among the Fathers³ of High-Energy Physics (HEP) in Spain !

5. PACO Mobilities

- CERN - Theory division
- Michigan (Veltman-Zakharov)
- Marseille (de Rafael),
- NIKHEF, Brookhaven, Orsay, Saclay, Groningen, Vienna, La Plata, Bogotá, Caracas.

6. PACO Societies & Honours

- Founder member of the European Physical Society
- Invited member of the American Association for the Advancement of Science
- Invited member of the New York Academy of Sciences
- Member of the Spanish Royal Physics Society
- Member of the Spanish Royal Mathematical Society.

7. International Committee Member and Participation to Conferences

- Series of Confinement : since its creation in 1994
- Series of QCD-Montpellier: since its creation in 1985.

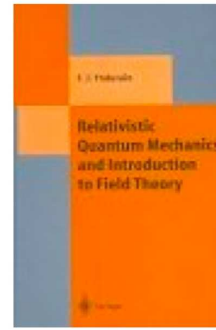
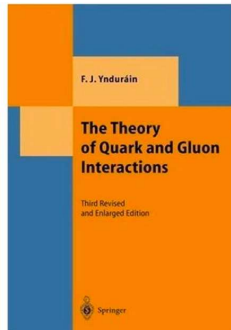
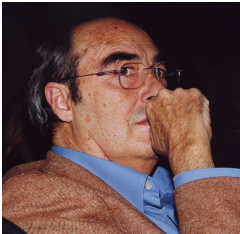
³It includes my former collaborator and friend Pedro Pascual who also left us few years ago.

8. PACO (wide) Research Interests: an Outstanding Physicist !

Publications

Paco has worked in different fields of High-Energy Physics (electroweak, supersymmetry, QCD, pion-pion scattering,...). He has written:

- 158 publications (articles and conference talks)
- Well-known QCD and QM books.



I classify below his different contributions to each fields in High-Energy Physics. The exact references of his papers can be e.g. found on-line in SLAC QSPIRES:

<http://www.slac.stanford.edu/spires/find/hep/wwwcite?rawcmd=FINN+AUTHOR+yndurain>

EW Publications

- 1979-1981 with C. Jarlskog & De Labastida: Proton decay
- 1984 with Alvarez, Herrero, Ibanez & Lopez : SUSY
- 1983-85 with Cecilia Jarlskog : # of families & space-time
- 1989 with Tini Veltman : rad. corr. in WW scattering.



QCD publications

Vector Meson Dominance

- 1978-83 with Bernabeu, Bramon, Espriu, Tarrach.

Running Light Quark Masses

- 1979-80 with Becchi, Narison & de Rafael
- Other papers since 1980 and in 1982 with Gonzalez-Arroyo, Martinelli.

Deep Inelastic Scatterings

- 1979-99 with Escoubes, Gonzalez-Arroyo, Herrero, Lopez & Santiago : NLO & NNLO structure functions, α_s determination

- 1997 with Adel, Barreiro, Labarga & Vermaseren : Pomeron and small-x.

Heavy Quarkonium properties

- 1995-2000 with Pineda, Titard & Simonov : m_c , m_b and η_b

Gluon condensate determination

- 1999 : QCD spectral sum rules

Hadronic Contributions to $g-2$ and $\alpha(M_Z)$

- 1983 with Casas & Lopez and 2001, 2005 with Troconiz
- Hot debate with Davier et al.



Analyticity and $\pi\pi$ scatterings

- Since 1969 with \neq collaborators : Adler, Aguilar-Benitez, Atkinson, Cerrada, Common, Garcia-Martin, Gervais, Izquierdo, Johnson, Kaminski, Lopez, Mahoux, Palou, P & R. Pascual, Pelaez, Sanchez Gomez.
- Recent Hot Debate with Caprini, Gasser & Leutwyler: Paco has wished to close this debate in Montpellier but the Bern group did not come in 2006. The meeting has been planned for this year 2008. Paco has cancelled his participation to QCD 08 15 days before he left us !

Comments and Famous Papers

Most of his papers had an impact in the developments of the related fields. In addition to his famous QCD book and to his recent work on $\pi\pi$ scattering reviewed in:

- In memory of Paco Yndurain: A Precise determination of pi pi scattering..., J.R. Pelaez, R. Garcia-Martin, R. Kaminski, F.J. Yndurain, QCD 08 (Montpellier 7-12th July 2008: arXiv:0810.2204 [hep-ph]),

his most quoted works in electroweak interactions are:

- Matter Instability in the Su(5) Unified Model of Strong, Weak and Electromagnetic Interactions, C. Jarlskog, F.J. Yndurain, Nucl. Phys. B149:29,1979.
- Radiative Corrections to W W Scattering, M.J.G. Veltman, F.J. Yndurain, Nucl. Phys. B325:1,1989.
- How To Look For Squark with the Anti-P P Collider, M.J. Herrero, Luis E. Ibanez, C. Lopez, F.J. Yndurain, Phys. Lett. B132:199-201,1983.

while his famous works in QCD are:

- The Hadronic contributions to the anomalous magnetic moment of the muon, J.F. de Troconiz, F.J. Yndurain, Phys. Rev. D71:073008,2005 [hep-ph/0402285].
- Calculation of quarkonium spectrum and $m(b)$, $m(c)$ to order α_s^4 , A. Pineda, F.J. Yndurain, Phys.Rev.D58:094022,1998 [hep-ph/9711287].

- Rigorous QCD evaluation of spectrum and ground state properties of heavy q anti- q systems: With a precision determination of $m(b)$ $M(\eta(b))$,
S. Titard, F.J. Yndurain, Phys.Rev.D49:6007-6025,1994 [hep-ph/9310236].
- Light Quark Masses in Quantum Chromodynamics and Chiral Symmetry Breaking,
C. Becchi, Stephan Narison, E. de Rafael, F.J. Yndurain, Z.Phys.C8:335,1981.
- Second Order Contributions to the Structure Functions in Deep Inelastic Scattering,
Antonio Gonzalez-Arroyo, C. Lopez, F.J. Yndurain, Nucl. Phys. B153:161-186,1979.
- Reconstruction of the Deep Inelastic Structure Functions from their Moments,
F.J. Yndurain, Phys.Lett.B74:68,1978.

9. Epilogue

Why PACO not Fransisco ?

- Saint Francisco was the founding father of a monastic community.
- PACO was actually called the "Father of the Community". In latin: "PAter COmunalis": Alvaro de Rujula wrote PAKO which is stronger in Spanish ! (from Eduardo de Rafael).
- Indeed, Pako was among the Fathers of the HEP Spanish Research and the Father of the Physics Department in the Autonoma Univ. of Madrid.
- Pako also had a huge influence in the Spanish and International Physics Communities.
- Pako was a "typical Spanish man" for being professionally arrogant but a gentleman in every days life.

10. Tribute to PAKO !

- *His death is certainly a big lost to Physics and especially to his Family to whom we address our sincere condolences !*
- *However, Death is like our Life, a Natural Phenomena !*
- *PAIX A TON AME : PAKO !*



Acknowledgement

It is a pleasure to thank Elena Yndurain and José Pelaez for communicating some of the photos, Nora Brambilla and Matthias Neubert for their invitation to present and to publish this emotional talk.